

WHAT IS CLAIMED IS:

1. An organic electroluminescent device having a luminescent material-containing layer interposed between a positive electrode and a negative electrode and designed to supply an electrical energy to the luminescent material that emits light upon receipt of the energy, said negative electrode containing f and p elements wherein:

said f is at least one element selected from those having electronegativity values higher than that of calcium, and, equal to or lower than that of vanadium; and

said p is at least one element selected from those having electronegativity values equal to or higher than that of aluminum.

2. The organic electroluminescent device of claim 1, wherein said p element is selected from those having electronegativity values equal to or higher than that of aluminum, lower than that of carbon, and lower than that of iodine.

3. The organic electroluminescent device of claim 1, wherein said luminescent material-containing layer at least contains a host, as a principal component, and a fluorescent dopant, and a ratio in molar mass of said dopant molecule to said host molecule (dopant/host) is in the range of 0.344 - 2.90.

4. The organic electroluminescent device of claim 1,

wherein said f is at least one element selected from Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu.

5        5. The organic electroluminescent device of claim 1, wherein said f is at least one element selected from Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er and Yb.

6. The organic electroluminescent device of claim 1, wherein said f is at least one element selected from La, Ce, Pr, Eu and Yb.

10       7. The organic electroluminescent device of claim 1, wherein said f is at least one element selected from Sc, Y, Ce, Pr, Nd, Gd, Tb, Dy, Ho, Er and Lu.

8. The organic electroluminescent device of claim 1, wherein said f is at least one element selected from Sm, Eu, Tm and Yb.

15       9. The organic electroluminescent device of claim 1, wherein said f is at least one element selected from Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm and Lu.

20       10. The organic electroluminescent device of claim 1, wherein said p is at least one element selected from Zn, B, Al, In, Tl, Si, Ge, Sn, P, Sb, Bi, S, Se and Te.

25       11. The organic electroluminescent device of claim 1, wherein a mean electronegativity value  $E_{ave}$ , as calculated from weighting an electronegativity value of each negative electrode-constituting element by a proportion in number of its atoms present in the negative electrode, is in the range

of 1.50 - 1.91, supposed that an electronegativity value of a lanthanoid element, such as Ce, is 1.15.

12. The organic electroluminescent device of claim 1, wherein when said device is operated by a flow of an DC  
5 current to emit light with a controlled luminance of 100  $\text{cd/m}^2$ , an emission efficiency, as calculated by dividing the luminance by a current density, is not below 10.0  $\text{cd/A}$ .

13. An organic electroluminescent device having a luminescent material-containing layer interposed between a  
10 positive electrode and a negative electrode and designed to supply an electrical energy to the luminescent material that emits light upon receipt of the energy, said negative electrode containing f, p and d elements wherein:

said f is at least one element selected from those  
15 having electronegativity values higher than that of calcium, and, equal to or lower than that of vanadium;

said p is at least one element selected from those having electronegativity values equal to or higher than that of aluminum; and

20 said d is at least one element selected from those having electronegativity values equal to or higher than any of those of iron, cobalt and nickel, and, equal to or lower than that of gold, said d being excluded from the selection of said f or p element.

25 14. The organic electroluminescent device of claim 13,

wherein said p element is selected from those having electronegativity values equal to or higher than that of aluminum, lower than that of carbon, and lower than that of iodine.

5           15. The organic electroluminescent device of claim 13, wherein said luminescent material-containing layer at least contains a host, as a principal component, and a fluorescent dopant, and a ratio in molar mass of said dopant molecule to said host molecule (dopant/host) is in the range of 0.344 -  
10       2.90.

          16. The organic electroluminescent device of claim 13, wherein said f is at least one element selected from Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu.

15           17. The organic electroluminescent device of claim 13, wherein said f is at least one element selected from Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er and Yb.

          18. The organic electroluminescent device of claim 13, wherein said f is at least one element selected from La, Ce, Pr, Eu and Yb.

20           19. The organic electroluminescent device of claim 13, wherein said f is at least one element selected from Sc, Y, Ce, Pr, Nd, Gd, Tb, Dy, Ho, Er and Lu.

          20. The organic electroluminescent device of claim 13, wherein said f is at least one element selected from Sm, Eu,  
25       Tm and Yb.

21. The organic electroluminescent device of claim 13, wherein said f is at least one element selected from Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm and Lu.

22. The organic electroluminescent device of claim 13, wherein said p is at least one element selected from Zn, B, Al, In, Tl, Si, Ge, Sn, P, Sb, Bi, S, Se and Te.

23. The organic electroluminescent device of claim 13, wherein said d is at least one element selected from Fe, Ru, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag and Au.

24. The organic electroluminescent device of claim 13, wherein said p is Al and said d is at least one element selected from Co, Ni, Cu and Ag.

25. The organic electroluminescent device of claim 13, wherein said p is Sb and said d is at least one element selected from Ag, Cu, Au and Al.

26. The organic electroluminescent device of claim 13, wherein said p is Bi and said d is at least one element selected from Ag, Cu, and Au.

27. The organic electroluminescent device of claim 13, wherein a mean electronegativity value  $E_{ave}$ , as calculated from weighting an electronegativity value of each negative electrode-constituting element by a proportion in number of its atoms present in the negative electrode, is in the range of 1.50 - 1.91, supposed that an electronegativity value of a lanthanoid element, such as Ce, is 1.15.

28. The organic electroluminescent device of claim 13, wherein when said device is operated by a flow of an DC current to emit light with a controlled luminance of 100 cd/m<sup>2</sup>, an emission efficiency, as calculated by dividing the luminance by a current density, is not below 10.0 cd/A.

29. An organic electroluminescent device having a luminescent material-containing layer interposed between a positive electrode and a negative electrode and designed to supply an electrical energy to the luminescent material that emits light upon receipt of the energy, said negative electrode containing f and p elements wherein:

said f is at least one element selected from La, Ce, Eu and Yb; and

said p is at least one element selected from Zn, Al, Sn and Sb.

30. The organic electroluminescent device of claim 29, wherein said f element is Ce and said p element is Al.

31. The organic electroluminescent device of claim 29, wherein said negative electrode comprises a first layer closest to said luminescent material-containing layer, a second layer overlying said first layer and a third layer overlying said second layer, and wherein said first negative electrode layer is substantially formed from said f element, said second negative electrode layer from a mixture or compound of said f and p elements and said third negative

electrode layer from said p element.

32. The organic electroluminescent device of claim 31, wherein said second negative electrode layer has such a composition gradient in its thickness direction that toward  
5 its interface with the third negative electrode layer from its interface with the first negative electrode layer, its f element content decreases while its p element content increases.

33. The organic electroluminescent device of claim 31,  
10 wherein at least one of said first, second and third negative electrode layers contains an additional element different from the constituent element thereof.

34. The organic electroluminescent device of claim 1,  
15 wherein said negative electrode comprises a first layer closest to said luminescent material-containing layer, a second layer overlying said first layer and a third layer overlying said second layer, and wherein said first negative electrode layer is substantially formed from said f element,  
20 said second negative electrode layer from a mixture or compound of said f and p elements and said third negative electrode layer from said p element.

35. The organic electroluminescent device of claim 1,  
25 wherein said second negative electrode layer has such a composition gradient in its thickness direction that toward its interface with the third negative electrode layer from

its interface with the first negative electrode layer, its f  
element content decreases while its p element content  
increases.

36. The organic electroluminescent device of claim 1,  
5 wherein at least one of said first, second and third  
negative electrode layers contains an additional element  
different from the constituent element thereof.

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